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(54) An adjustable folding ladder.

(57) The invention is an adjustable folding ladder that can be easily altered in its length and shape to adjust to the proper working height and angles for the user. With the fiber glass nylon hinges(1), the ladder is insulated to prevent the user from electrical shocks in the event the ladder comes into contact with electrical wiring.

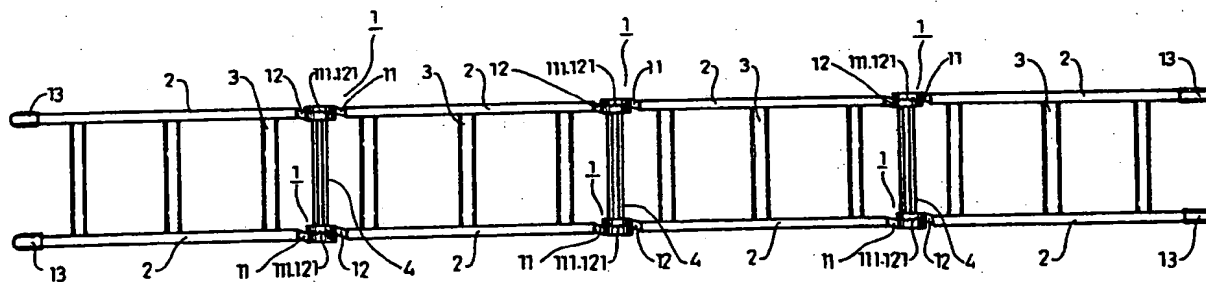


FIG. 17

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## AN ADJUSTABLE FOLDING LADDER

### BACKGROUND OF THE INVENTION

Standard folding ladders are available in 12', 16' and 20' length increments. It is hazardous to perform work at high levels using a ladder of improper length. On the other hand, it is inconvenient to carry ladders of various lengths to the work site. And for household use, it is not economical to purchase more than one ladder. Normal size households do not have storage available for long ladders.

Whether the user is using the ladder at home or at the job site, there are times that the user may be working close to electrical wiring. If the ladder comes into contact with the wiring and it is not properly grounded, it may produce an electrical shock to the user. An all metal ladder will be hazardous in such situation.

This invention is an adjustable folding ladder designed to solve the aforementioned concerns for the users. The ladder is designed to allow users to adjust the length of the ladder to various heights, up to 20 feet, where they need to perform their work. This feature allows the users the flexibility of not having to carry more than one ladder to the work site. In addition, the ladder also features a fiber glass nylon hinge to provide insulation and proper grounding. It insulates the users from electrical shock in case the ladder comes into contact with electrical wiring.

### SUMMARY OF THE INVENTION

This invention is an adjustable folding ladder allowing the user to adjust the ladder to the proper length to reach the level where work needs to be performed. It also features a design to insulate the user from electrical shock.

This adjustable folding ladder is composed of four sections connected with three pairs of hinged joints. Each section is made up of two upright legs, connectors at the hinged joints and horizontal rungs between the uprights for stepping. Two sections are connected with hinged joints on each side with a connector machined with left-handed threads on one end and right-handed threads on the other. Combined with the corresponding threads on the hinged joints screws, the connector can be turned one way to tighten the hinged joints to fix the position of the ladder. Turning the connector the opposite way will loosen up the hinged joint for adjusting the relative position of the sections to

various angles and for changing the height of or folding the ladder. The ladder is generally stored in the folded position.

### BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a front view of the male hinge in this invention.

Figure 2 is a side view of the male hinge in this invention.

Figure 3 is a front view of the female hinge in this invention.

Figure 4 is a side view of the female hinge in this invention.

Figure 5 is an upside view of the upright of the ladder in this invention.

Figure 6 is a side view of the upright of the ladder in this invention.

Figure 7 is a top view of the rung of the ladder in this invention.

Figure 8 is a side view of the rung of the ladder in this invention.

Figure 9 is a top view of the connector of the ladder in this invention.

Figure 10 is a side view of the connector of the ladder in this invention.

Figure 11 is an upside view of the hinge joint inserted in the uprights of the ladder in this invention.

Figure 12 is a cross-sectional view of the 12-12 line in figure 11.

Figure 13 is an upside view of the upright with a cross-sectional view of a rung attached to the upright.

Figure 14 is a cross-sectional view of the 14-14 line in figure 13.

Figure 15 is a side view of the ladder in this invention folded to its minimum size for storage.

Figure 16 is a side view of the ladder in this invention in a reversed V-shape position.

Figure 17 is a front view of the ladder in this invention in its maximum length position.

### DETAILED DESCRIPTION OF THE INVENTION

The ladder in this invention, as shown in Figure 17, consists of six hinged joints 1, eight uprights 2, twelve rungs 3 and three connectors 4 as its main parts.

Hinged joint 1 consists of a male hinge 11 and a female hinge 12 made of insulation material, fiber

glass nylon.

The male hinge 11, as shown in Figures 1 and 2, has precut teeth 111 and a screw inserted in the center. The threads of the screw for the male hinge on one side of the upright is left-handed. The threads of screw for the male hinge on the other side of the upright is right-handed. The handle of the male hinge has multiple grooves 113 cut inward.

The female hinge 12, as shown in Figures 3 and 4, has precut teeth 121 and multiple grooves 123 similar to those in the male hinge. The teeth are cut to mesh with those in the male hinge as shown in Figures 11 and 12. The screw 112 of the male hinge is to be inserted in the axle hole 122 in the center of the female hinge 12.

The upright 2 as shown in Figures 5 and 6 is made of aluminium. It is shaped by pressing. It is hollow with a lengthwise inner hole 23. Its ends have 10 grooves punched in to fit the corresponding grooves 113 of the male hinge 11 or the grooves 123 of the female hinge 12. When the handle of the male hinge 11 or the female hinge 12 is inserted in the lengthwise inner hole 23 in the upright, the grooves on the handle will lock in with the corresponding grooves on the upright, thus combining the hinged joint 1 and the upright 2 without drilling and riveting, as shown in Figure 11.

The upright 2 also has round flat-head screw holes 21 and grooves 22 produced by pressing. The ends of the rung fit in the grooves 22 and are secured to the uprights by flat-head screws 24 through holes 21. This way of securing the rungs provides increased stepping weight capacity. Long metal strips 25 are then inserted in the stabilizing grooves 26 with tight tolerance lengthwise in the upright 2 to prevent the flat-head screws 24 from loosening. Besides, it made the screws invisible from outside.

The rung 3, as shown in Figures 7 and 8, is made of aluminum. It has lengthwise swellings to produce a rough surface for increased traction. This feature minimizes slippage for safety when the user climbs up the ladder. The cross-section is tubular shape to increase the strength of the rung. The holes 31 and wall 32 fit in with the holes 21 and grooves 22 on the upright 2 for fastening purposes to provide additional strength.

The connector 4, as shown in Figures 9 and 10, is made of aluminum. It has a lengthwise round hole 41 with one end cut with female left-handed threads and the other end with female right-handed threads. The corresponding left-hand or right-hand threaded screw 112 on the male hinge 11 is used to attach the connector to the hinged joint 1.

Figures 11 and 12 show the hinged joint 1 is attached to the uprights 2. By pinching the outside of the upright 2 with the appropriate tool, the

grooves 113 on the male hinge 11 or the grooves 123 on the female hinge 12 can be fitted into the 10 grooves punched in at the end of the upright 2. This fitting process results in a permanent locking position between the hinged joint 1 and the upright 2 to minimize any future separation between the two. Connector 4 is then attached to the hinged joints 1 on both sides by tightening flat-head screw 112. As mentioned previously, the flat-head screw 112 has two types of male threads, left-handed and right-handed. Each type is used in fastening the connector 4 on opposite sides to the hinged joint 1. One way turning of the connector 4 can loosen up both screws 112 on both ends of the connector. When the flat-head screws 112 are loosened, teeth 111 of the male hinge 11 disengage from teeth 121 of the female hinge 12. This action allows the user to rotate the hinged joint to adjust the angle between two sections of the ladder. When the proper angle or position is attained, the connector 4 can be turned the opposite direction to tighten the flat-head screws 112. When the screws are tightened, the teeth on the male and female hinges are locked in the proper position desired by the user.

As shown in Figures 13 and 14, rung 3 is attached to the upright 2 by flat-head screw 24 through the holes on the upright 2 and the rung 3. After all the rungs are attached, a long metal strip 25 is then inserted lengthwise in the grooves 26 on the upright to prevent the screws from loosening, and screws are invisible from outside.

The adjustable folding ladder in this invention is composed of four straight sections connected by three pairs of hinged joints. When folded in its fully retracted position, it measures one quarter of its fully extended length. It can be adjusted into an M-shape (Figure 15), a reversed V-shape (Figure 16) or a straight length when fully extended. The alteration of its shape can be accomplished by turning the connectors 4 to loosen the hinged joints 1 on both sides simultaneously; separating teeth 111 of the male hinge from those of the female hinge; adjusting the hinged joint to attain the desired angle and then turning the connectors 4 to tighten the hinge joints to lock them in position.

This ladder has several advantages. It allows the user flexibility when adjusting to various positions. It provides insulation from electrical shocks. Plastic stoppers are affixed at the ends of the uprights for the first and last sections of the ladder to prevent the ladder from slipping.

## Claims

1. An adjustable folding ladder comprising -hinged joints (1) made of fiber glass nylon providing electrical shock insulation, each composed of a

male hinge (11) and a female hinge (12) with matching teeth (111), (121) for close tolerance engagement, having handles with grooves (113), (123) pressed in to fit the grooves (22) on the upright (2) for permanent locking position, and having screw (112) with either left-handed or right-handed threads to fit through the male hinge (11) in the middle of its teeth (111) and through the hole (122) in the middle of the female hinge (12),  
-uprights (2) made of aluminum with a lengthwise hollow hole (23) to fit the handle of the hinged joint (1), with grooves (22) to fit the corresponding grooves (113), (123) on the hinged joint (1) to provide a permanent locking position, having round flat-head screw holes (21) and grooves (22) to fit the rungs (3), and having grooves (26) to allow a long metal strip (25) to be inserted lengthwise to prevent the flat-head screws (24) from loosening,  
-rungs (3) made of aluminum in tube shape to provide rigidity, having lengthwise swellings to minimize slipping, and having screw holes (31) and wall (32) to be attached to the uprights (2) by screwing and fitting into the corresponding holes (21) and grooves (22) in the uprights to provide increased load carrying capacity, and  
-connectors (4) having female left-hand and right-hand threaded holes (41) on opposite ends to fit the corresponding screws (112) of the hinged joints (1) such that the hinged joints (1) can be tightened or loosened by turning the connector (4).

2. The adjustable folding ladder as claimed in Claim 1, wherein two uprights (2) are connected together with a hinged joint (1) to make up a leg of this ladder, two legs are symmetrically connected by rungs (3) and connectors (4), which have left-hand and right-hand threaded holes (41) to fit the corresponding threads on the screws (112) of the hinged joint (1), and the hinged joint (1) can be tightened or loosened by turning the connector (4) in opposite directions.

3. The adjustable folding ladder as claimed in Claim 1, wherein when the hinged joints (1) are loosened by turning the connector (4), the teeth (111), (121) of both the male and female hinges (1) can be separated to allow the user to adjust the angle between the legs of the ladder, and by adjusting the angles between the legs, the ladder can be shaped into different configurations.

4. The adjustable folding ladder as claimed in Claim 1, wherein the hinged joints (1) are made of fiber glass nylon thus providing insulation to electrical shocks in the event the ladder comes into contact with electric wiring.

5. The adjustable folding ladder as claimed in Claim 1, wherein the flat-head screws (24) used to connect the rungs (3) to the uprights (2) are inserted in the grooves (22) in the uprights (2). A lengthwise metal strip (25) can be inserted in the

grooves (26) to prevent the screws (24) from loosening and being seen from outside.

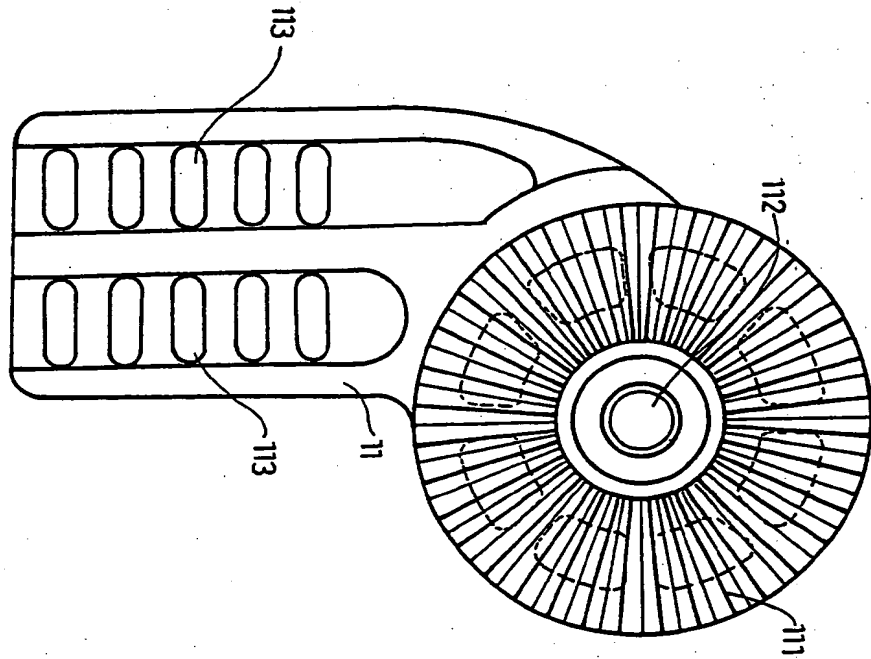


FIG. 1

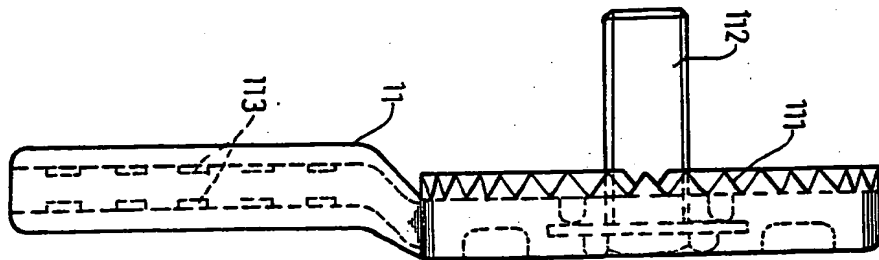


FIG. 2

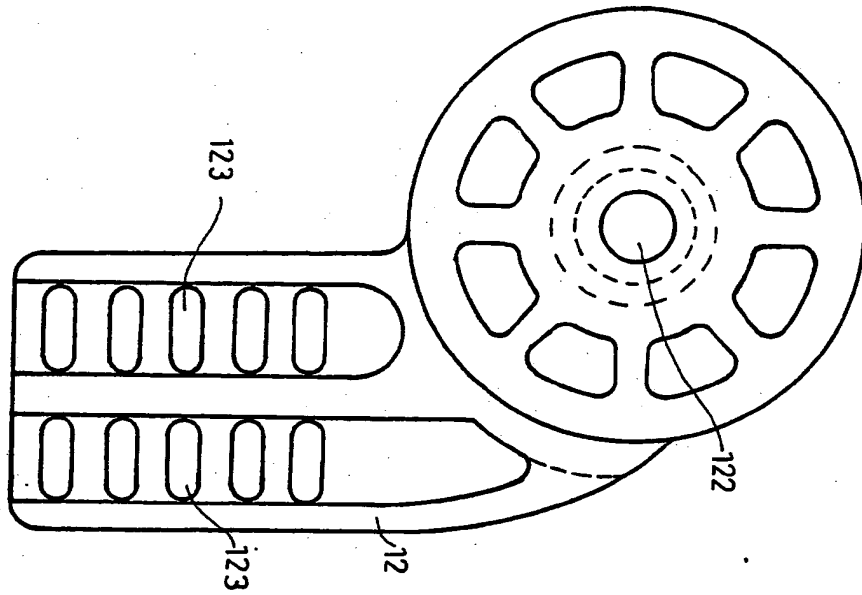


FIG. 3

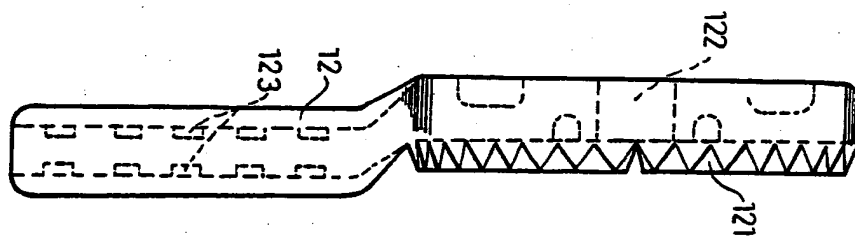


FIG. 4

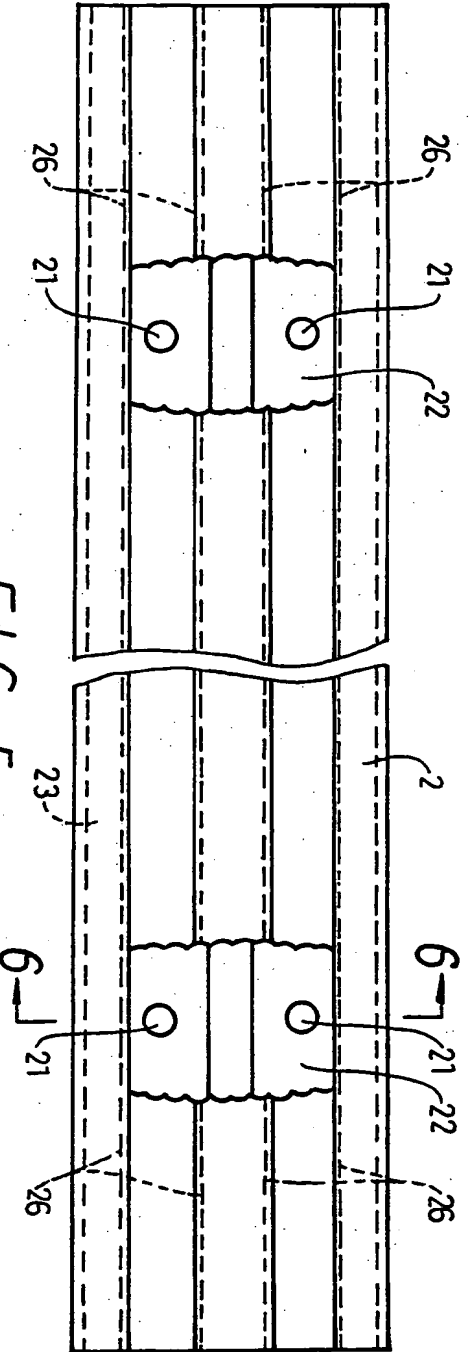


FIG. 5

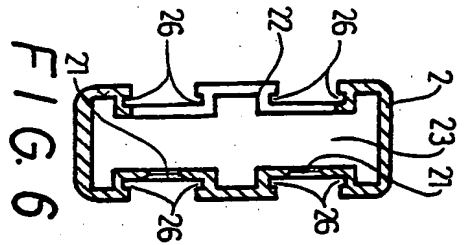


FIG. 6

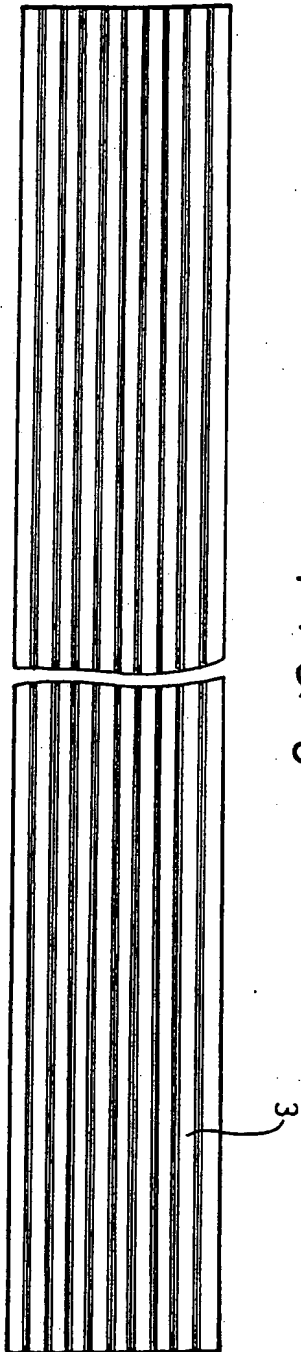


FIG. 7

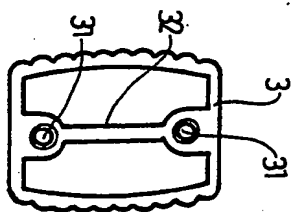


FIG. 8

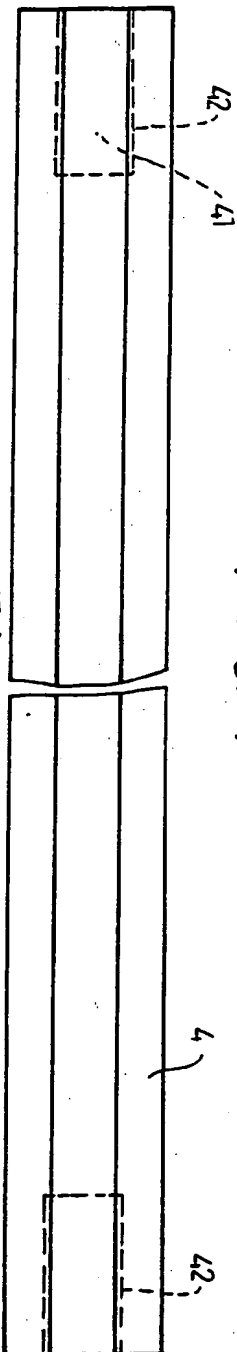


FIG. 9

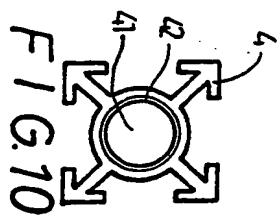
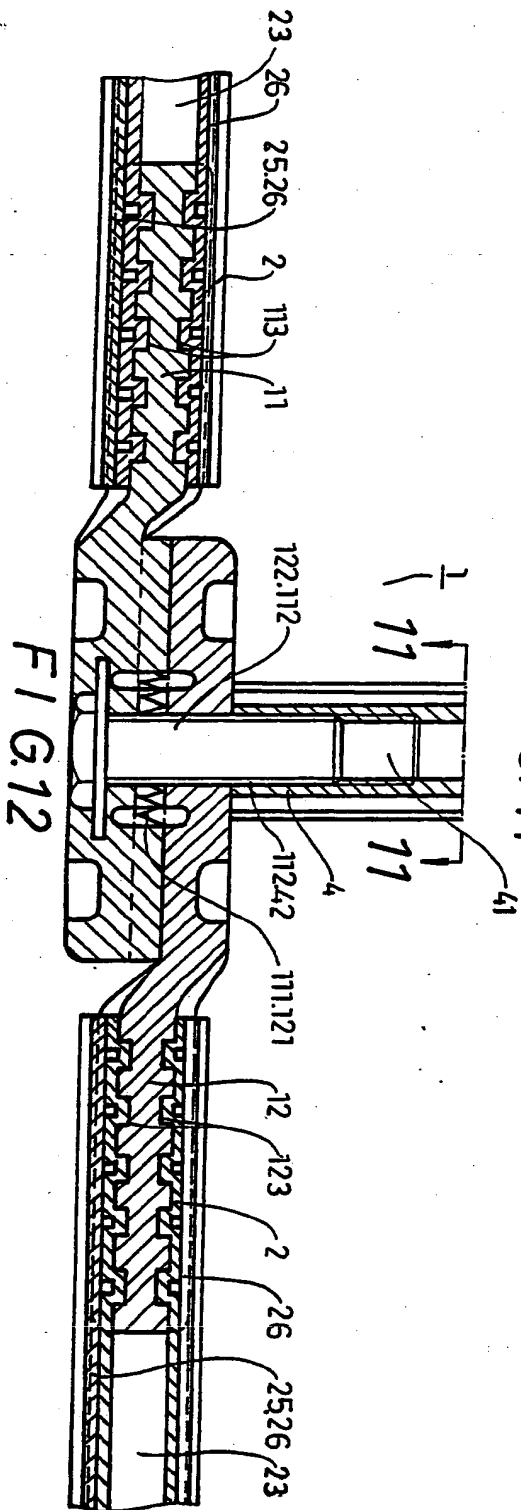
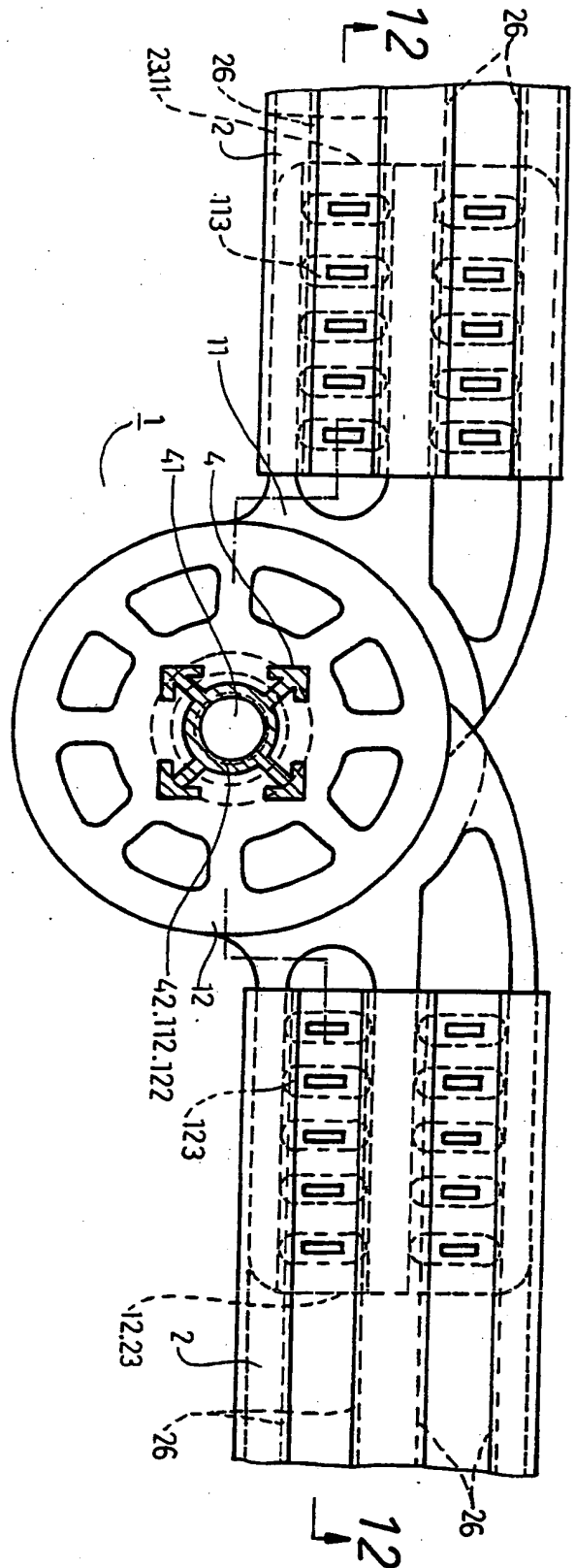


FIG. 10





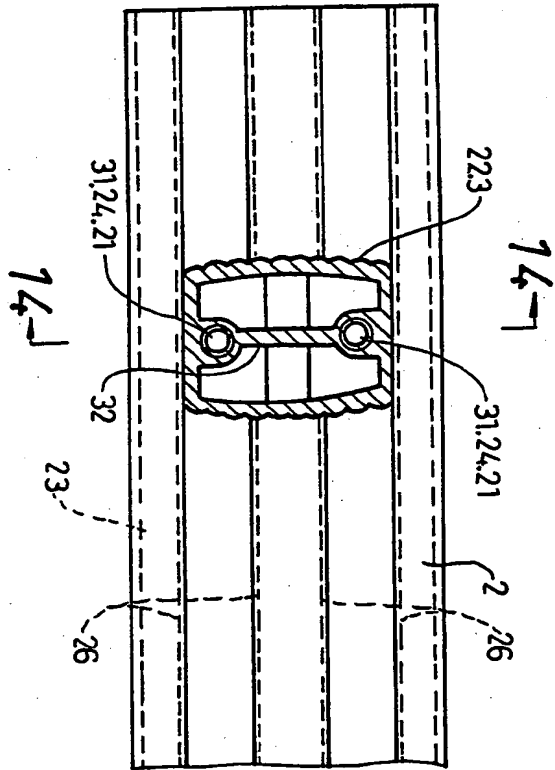


FIG. 13

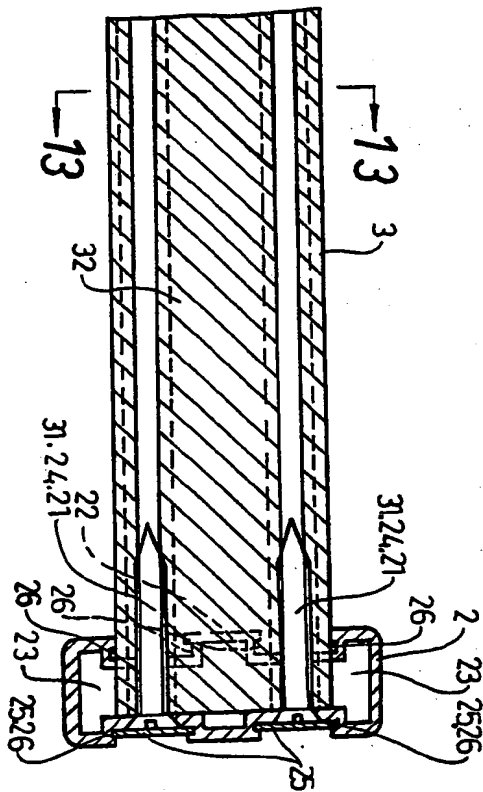


FIG. 14

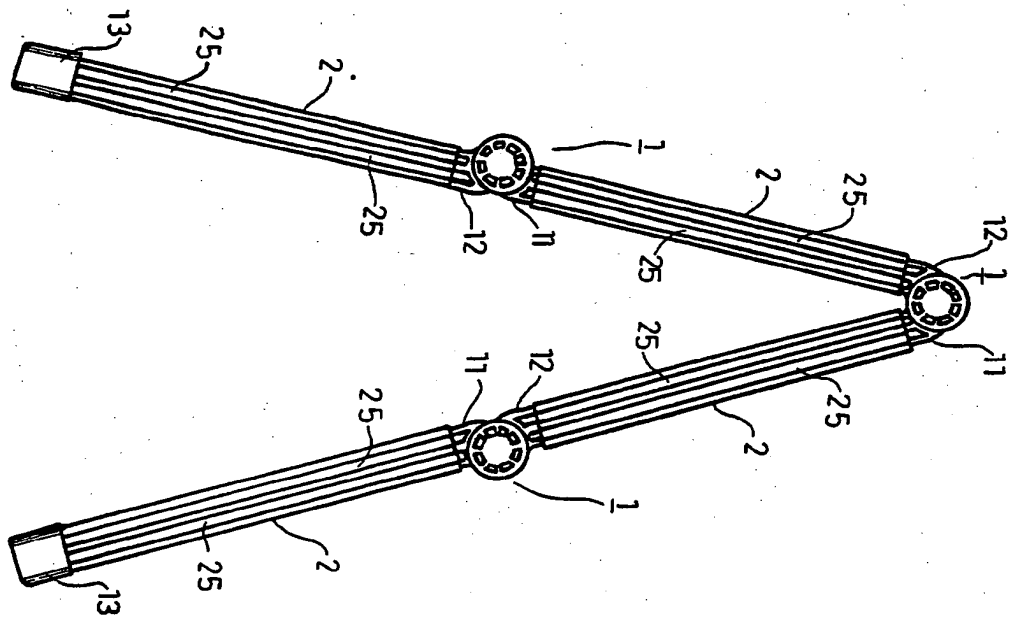


FIG. 16

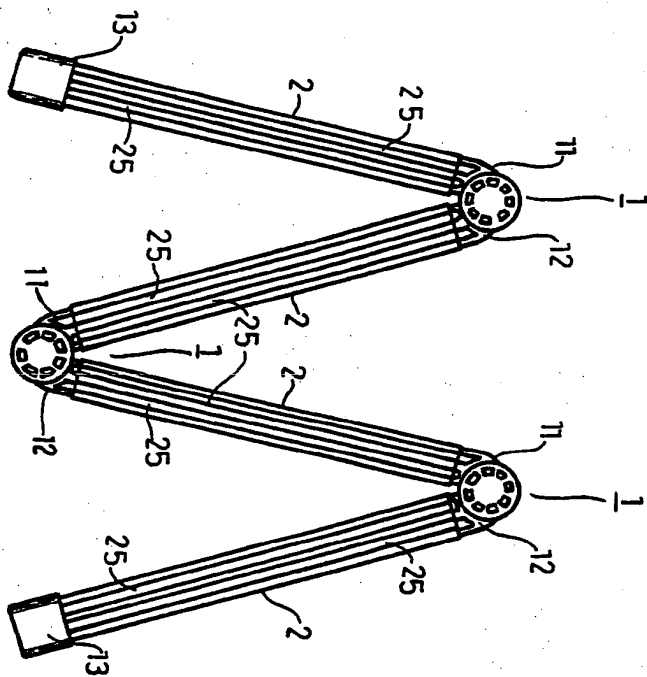
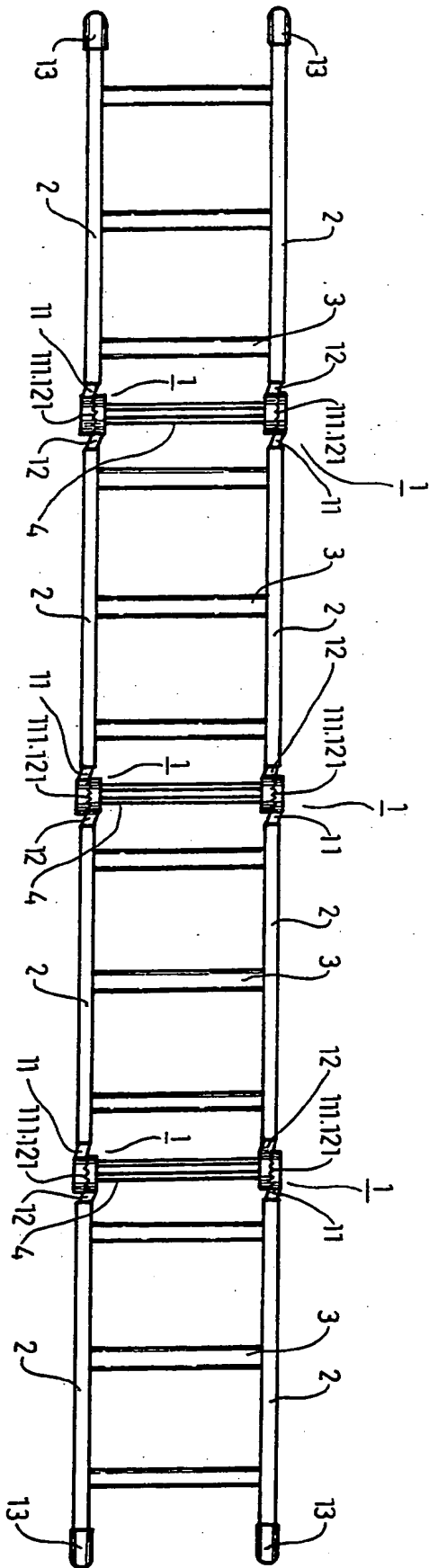


FIG. 15



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# EUROPEAN SEARCH REPORT

Application Number

EP 88 10 0903

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
A	FR-A-2 534 307 (MANUFACTURE D'ARMES ET CYCLES DE CHATELLERAULT) * Page 1, line 26 - page 2, line 48; figures 1-5 *	1	E 06 C 1/32
A	US-A-4 376 470 (ASHTON) * Column 3, lines 43-53; column 4, lines 41-50; figure 1 *	1	
A	FR-A-2 082 571 (FRASSETTO) * Page 5, line 8 - page 6, line 18; figures 1-5 *	1	
A	DE-A-2 650 006 (PLASTIK-SPRITZWERK AG) * Page 7, lines 9-16; page 8, line 19 - page 9, line 7; figures 1-3,10,11 *	1	
A	DE-A-3 027 240 (ZEYHER GmbH & CO.) * Page 11, line 6 - page 12, line 17; figures 1-4,7 *	1	
A	EP-A-0 000 499 (ZARGES LEICHTBAU GmbH) * Page 5, lines 1-27; figures 1,4 *	1	TECHNICAL FIELDS SEARCHED (Int. Cl.4)
A	DE-A-2 241 533 (M. STRÜWER METALLWARENFABRIK) * Page 6, line 2 - page 7, line 4; figures 1-7 *	1	E 06 C
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 12-09-1988	Examiner BELTZUNG F.C.
<b>CATEGORY OF CITED DOCUMENTS</b>			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ----- & : member of the same patent family, corresponding document	